Ultimate (magnetic) characterization: new opportunities for element-specific and macroscopic investigations at ID12, ESRF

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In this presentation, we will introduce new instruments which have been implemented at the beamline ID12 of the European Synchrotron Radiation Facility (ESRF), in the framework of the "ULMAG—Ultimate MAGnetic characterization" project funded by BMBF (grant 05K2019). These instruments offer the ESRF users a unique possibility to measure under strictly the same experimental conditions the element-specific X-ray absorption spectroscopy (XAS)/ X-ray magnetic circular dichroism (XMCD), high-resolution XRD simultaneously with the measurement of various macroscopic properties (magnetization, volume changes, magnetocaloric properties, resistivity etc.), all as a function of magnetic field (up to 17 T) and temperature (5–325 K) [1].
To demonstrate the potential and features of these scientific instruments, we present two case studies: (1) FeRh, which has a first-order anti-ferromagnetic to ferromagnetic transition around room temperature and (2) HoCo2, which exhibits a first-order ferrimagnetic to paramagnetic transition. These two cases demonstrate new horizons for studying the physics of magnetic materials, where the interplay between the magnetic, structural, and electronic subsystems of the solid is essential [2,3].

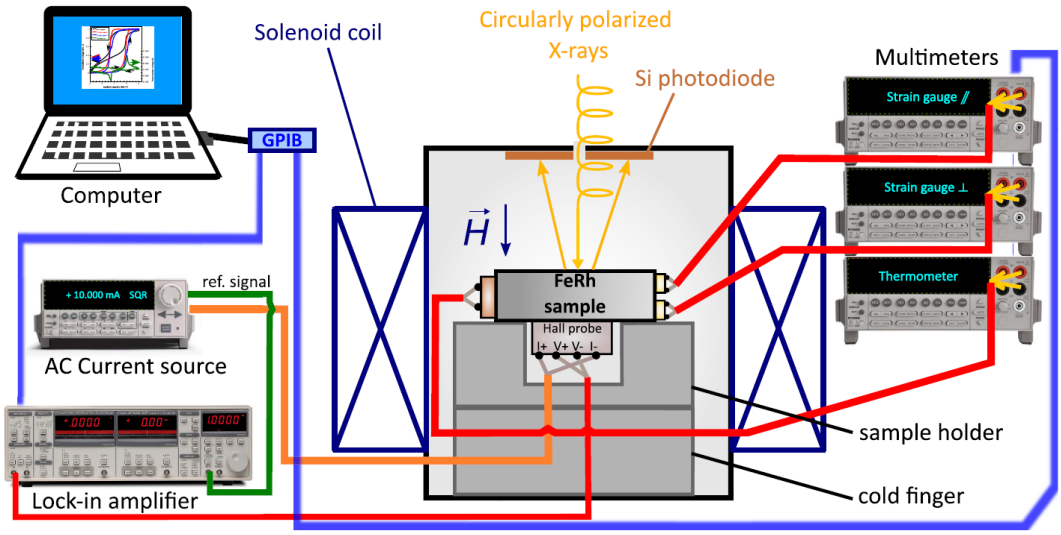

Figure 1: Schematic of the prototype for simultaneous measurements of: (i) magnetic stray field using Hall probe; (ii) magnetovolume change; (iii) sample's temperature change; and (iv) XMCD signal, implemented at the beamline ID12 of the ESRF

References

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